

INTERCONNECT SYSTEM AND METHOD FOR MULTIPLE PROTOCOL SHORT MESSAGE SERVICES

The present invention relates to the exchange of short messages between a central location and a remote location, and more particularly to identifying the recipient of each short message, identifying the data format expected by the recipient of the short message and converting the received short message to the identified data format.

Short Message Service (SMS) is an inherent capability of most digital wireless telecommunications systems. The radio technologies associated with each of the digital wireless telecommunications system's are technically incompatible at the radio signal layer, but most are compatible at the intersystem SS7 transport layer. Currently, the differing RF technologies, e.g., time

division multiple access (TDMA), code division multiple access (CDMA), and global system for mobile telecommunications (GSM), have at least partial technical compatibility over the IS41 industry standard that is currently carried over the telephone industry's SS7
5 inter-networking system. The partial compatibility of these RF technologies is possible because the basic transport format is specified in the IS41 standard; however, many of the messaging details are implementation specific.

Even though it is possible for current short message
10 service center platforms (SMSC) to support all of these multiple protocols, typically, an installed SMSC only supports the protocol of the cellular telecommunication system into which it is installed. For example, if the SMSC is installed into an IS136 type TDMA system, the SMSC supports only the TDMA protocol. Similarly, if the
15 SMSC is installed into a GSM system, then the SMSC supports only the GSM protocol. In other words, although most current SMSC's can interface with any of the currently popular digital cellular systems, the SMSC's do so on an individual basis, not all simultaneously.

20 For example, in one network, the nodes communicate using different data formatting standards, such as integrated services digital network (ISDN) and the Japanese X.50 standard. Each of the nodes is connected to a format converter. The format converter acts as a bi-directional converter for converting between two data
25 formats and thus allows communication between the two nodes.

The format converter reformats the data formatted in the X.50 standard into the ISDN format. The format converter accomplishes the conversion by storing the incoming X.50 data in an aligned data RAM with offsets, to provide an appropriate

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alignment among the frames of the data. Then, a format conversion module reformats the data into the ISDN format one byte at a time.

In another network, a subscriber in an electronic messaging network can access messages in a variety of formats. A subscriber may receive messages through a variety of types of equipment, such as a voice mail system, an e-mail system, a facsimile machine and a telephone, all connected to a wireline network. The subscriber may access these messages through a pager, a cellular telephone, or a personal digital assistant, each connected to a different wireless network. The subscriber selects the wireline or wireless network and media format to be used for delivering messages or notifying a subscriber that a message has been received.

For example, the subscriber may elect to have notification of a voice mail or facsimile receipt directed to the personal digital assistant (PDA) in the form of an e-mail message. In accordance with the method of the network, the subscriber's selection is implemented through the personal intercommunications inter-networking system, which performs the appropriate data conversion from one protocol to another and delivers the e-mail message.

In yet another network, an intelligent signaling transfer point (ISTP) is included in a telephone network with a database for storing call processing control information. Calls from one station on the network to another are either passed through or intercepted at the ISTP and screened in accordance with criteria stored in the database, such as time of day, a certain originating area or caller, or a specified call count value.

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In still another network, a data collection device is provided for use with *any one of* the following: TDMA; CDMA; frequency division multiple access (FDMA); GSM; and personal access communications systems (PACS) technologies. But, the data
5 collection device does not use multiple such technologies in a single system.

Thus, there is a need for a system in which a central location can communicate with several remote stations, which use different digital cellular or personal communications system (PCS)
10 formats. The systems and methods discussed above only teach conversion between two specific formats.

SUMMARY OF THE INVENTION

The present invention meets the needs described above
15 by providing a system and method for interconnecting digital cellular systems of multiple formats so that a customer central location (CCL) can send short messages to, or receive short messages from, multiple remote locations using different digital cellular or PCS standards. A short message arbitrator (SMA)
20 intercepts a communication from the CCL to a remote location. The SMA retrieves information sent with the communication, such as the mobile identification number (MIN) or other identifying characteristic. The SMA uses the identifying characteristic to determine the mobile switching center (MSC) serving the remote
25 location, the wireless access method used in the MSC's market, the CCL's class of service and the type of transport to be used between the SMA and the MSC. Based on the information retrieved from the database, the SMA determines whether the communication needs to be converted. If the communication needs to be converted, then

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the SMA converts the communication to the format expected by the remote device and sends the communication over the appropriate transmission path.

5 The SMA also intercepts a communication from a remote location to the CCL. The SMA retrieves information sent with the communication, such as the MIN and MSC identifier, or other identifying characteristic. The SMA uses the identifying characteristic to determine the recipient of the communication, in this case the CCL, and the class of service expected by the recipient.
10 The SMA also uses the information stored in the database to determine whether the communication should be converted. If the communication should be converted, then the SMA performs the conversion and sends the communication to the CCL.

15 Therefore, it is an object of the present invention to provide a system and method for interconnecting multiple remote locations over multiple wireless (e.g., digital cellular and PCS) systems using multiple, otherwise incompatible protocols.

20 It is another object of the invention to provide a system and method for allowing a CCL to exchange short messages with such remote locations.

25 It is a further object of the invention to provide such a system and method using a single SMA which can determine the data format or short message system (SMS) protocol expected by the recipient (CCL or remote location), thereby avoiding the need for a separate bi-directional translator for every possible communication path.

It is still a further object of this invention to provide a method for integrating with and supporting all of the currently

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popular digital cellular systems, simultaneously, thus reducing deployment costs for cellular carriers.

It is yet another object of this invention to permit sending SMS messages originated in one type of cellular system to
5 another dissimilar cellular system in a transparent manner.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an interconnect system according to an exemplary embodiment of the present invention.

10 FIG. 2 is a block diagram of an exemplary short message arbitrator of the system of FIG. 1.

FIG. 3 is a flow diagram illustrating an exemplary communications method used by the CCL to transmit data to the remote locations.

15 FIG. 4 is a flow diagram illustrating an exemplary communications method used by the remote locations to transmit data to the CCL.

DETAILED DESCRIPTION

20 The present invention is directed to a system and method for interconnecting digital cellular systems of multiple formats so that a customer central location (CCL) can send short messages to, or receive short messages from, multiple remote locations using different digital cellular or PCS standards. Briefly
25 described, a short message arbitrator (SMA) intercepts a communication between the CCL and the remote locations. The SMA retrieves information sent with the communication, such as the mobile identification number (MIN) or other identifying characteristic. The information is used to search a database to

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determine the data format used by the sender and expected by the recipient. Based upon the information retrieved from the database, the SMA determines whether the communication should be converted. If the communication should be converted, then the
5 SMA converts the communication and transmits the communication to the intended recipient over the appropriate transmission path.

Exemplary System Architecture

FIG. 1 shows an exemplary system for providing a
10 flexible bi-directional data transport between a CCL 100 and one or more remote locations using wireless technologies. The CCL 100 sends and receives data to and from remote locations 123, 124, 125 and 126. Data from the CCL 100 is transferred to the SMA 104 using a public voice/data transport 102 over data circuits 101 and
15 103.

The SMA 104 converts the CCL's data to the proper format for transport to MSC's 109, 110, 117 and 119. The SMA 104 utilizes two routes for delivering the CCL's data to MSC's 109, 110, 117, and 119. The SMA 104 routes the CCL's data to one of
20 the MSC's 109, 110, 117, and 119 by: 1) using a data circuit 105 to an SS7/IS41 Network 106, then over a data circuit (107, 108, 115 or 116) to the MSC (109, 110, 117, or 119) that is intended to receive the transmitted data; or 2) using a data circuit 103 back to the public voice/data transport 102, then over a data circuit (111,
25 112, 118, or 120) to the MSC (109, 110, 117, or 119) that is intended to receive the transmitted data.

Depending on the wireless access method used at the remote location, the CCL's data is routed to the selected wireless market. For advanced mobile phone service (AMPS) wireless
30 communications, the data is transported from the MSC 109 to an

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After the SMA 104 receives the data from the CCL 100, it uses an identifying characteristic, such as the mobile identification number (MIN) or international mobile station

identifier (IMSI), that was received with the data, to retrieve the CCL's profile 130 from a SMA database 128. The SMA determines the following from the CCL profile: 1) the MSC (109, 110, 117, or 119) serving the remote radio (113, 114, 121 or 122); 2) the
5 wireless access method used in the MSC's market; 3) the CCL's class of service; and 4) the type of transport to use between the SMA 104 and the selected MSC (109, 110, 117, or 119). Based upon the information retrieved from the database, the SMA determines whether any alterations are required to the data or identifying
10 characteristic to make the data compatible with a technologically dissimilar receiving unit or system.

The CCL's class of service may include one of the following: "CELLEMETRY" data service; short message system (SMS); asynchronous digital data; or data over circuit switched
15 voice cellular. "CELLEMETRY" data service is available to AMPS (analog and digital) radios, SMS and asynchronous digital data are available to digital radios (CDMA, GSM and TDMA), and circuit switched voice cellular is available in all methods of wireless access. In addition, those skilled in the art will appreciate that other classes
20 of service may be used with the CCL 100 of the present invention.

For simplicity only one CCL 100 is illustrated in FIG. 1. However, the SMA can support multiple CCL's. Each CCL served by the SMA has a CCL identifier that is stored in the database.

25 FIG. 2 shows an exemplary SMA 104 of the present invention. The controller 201 manages communication over the data circuits 103 and 105. The SMA database 128 (FIG. 1) stores a profile for each CCL 100 supported by the SMA 104. The profile provides information to support the conversion and transport of

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data between a central location, such as CCL 100, and its remote locations, such as remote locations 123, 124, 125, and 126. From the stored profiles the SMA determines the recipient of the communication, as well as the method of data transport and any data conversions that are necessary.

The SMA analyzes the information about the CCL and the remote device stored in the database to determine whether the CCL and the remote are using compatible or incompatible data formats. If the CCL and the remote are using incompatible data formats, then the SMA converts the data. As will be apparent to one skilled in the art, the conversion from one data format into another can be managed in any suitable way, e.g., through multiple bi-directional translators 205.

Exemplary Communications Methods

FIG. 3 and FIG. 4 are flow diagrams illustrating exemplary communication methods of the present invention. These figures illustrate the communication methods utilized to transfer data between the customer central location (CCL) 100 and the remote locations (123, 124, 125, and 126) of FIG. 1. The communication methods of FIG. 3 and FIG. 4 allow the remote locations (123, 124, 125, and 126) and CCL 100 to communicate, even though they are connected by multiple wireless (e.g. digital cellular and PCS) systems using multiple, otherwise incompatible protocols or data formats. In discussing the following flow diagrams, reference will be made to the elements of FIG. 1.

FIG. 3 is a flow diagram illustrating the communications method 300 used by the CCL 100 to transfer data to a remote location (123, 124, 125, or 126). Communications

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Figure 4 is a flow diagram illustrating an exemplary remote communications method 400 used by the remote locations (123, 124, 125, or 126) to transfer data to the CCL 100. The remote communications method 400 illustrates the steps used by a
5 remote location (123, 124, 125, or 126) to transport data to the CCL 100. Remote communications method 400 begins at step 402 and proceeds to step 404. At step 404, the remote location (123, 124, 125, or 126) commands its radio (113, 114, 121, or 122) to send data to its associated MSC (109, 110, 117, or 119). At step
10 406, the MSC (109, 110, 117, or 119) receives the data and transports it to the SMA 104.

The remote communications method 400 then proceeds to step 408. At step 408, the SMA 104 receives the data and retrieves the identifying characteristics, such as the MIN (or IMSI)
15 and MSC identifier (MSCID), from the data. The SMA 104 searches the SMA database 128 using the MIN and MSCID that the MSC (109, 110, 117 or 119) transported with the data. Next, at step 410, the SMA 104 determines from the SMA database 128: 1) the CCL identifier; 2) the class of service used by the identified
20 CCL 100; and 3) the wireless access method used by the MSC.

The SMA compares the class of service used by the CCL and the wireless access method used by the MSC to determine whether the data formats are compatible in step 411. If the data formats are compatible, then the Yes branch is followed to step 413.
25 However, if the data formats are incompatible, then the No branch is followed to step 412 and the data is converted. Once the data is converted, the method proceeds to step 413. In step 413, the SMA delivers the data to the CCL. The SMA delivers the data to the CCL using a transmission path that is appropriate for the CCL identified

by the CCL identifier. Then, remote communications method 400 proceeds to step 414 and ends.

Exemplary Communications

5 The following examples are exemplary communications supported by the present invention. These examples are intended to illustrate some of the possible communication schemes, between the CCL 100 and the remote locations (123, 124, 125, and 126), that may be implemented with the present invention. These examples
10 are in no way intended to limit the scope of the invention. Those skilled in the art will appreciate that there are many other possible schemes and protocols that may be implemented with the present invention.

 In a first example, the CCL 100 sends data to the
15 remote location 123. The remote location 123 is associated with an AMP's radio 113 and the AMP's radio is served by MSC 109. The CCL's class of service is "CELLEMETRY" Data Service. The CCL 100 sends the MIN of the AMPS radio 113 along with the data to be transported to the SMA 104. The SMA 104 determines from the
20 SMA database 128 that the MIN corresponds to the AMP's radio 113; the class of service is "CELLEMETRY" Data Service; and the MSC 109 serves the radio 113.

 Depending on the type of mobile switching center, either an IS41 inter system page message is sent from the SMA 104
25 to the MSC 109 through data circuit 105, the SS7/IS41 network 106 and the data circuit 108; or a roamer-access call is made from the SMA 104 to the MSC 109 through circuit 103, public voice/data transport 102 and the data circuit 111. The SMA determines the appropriate method of transport between the SMA 104 and the MSC

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In another example, the remote location 123 sends data to the CCL 100. The remote location 123 is associated with the AMP's radio 113 and the AMP's radio is served by MSC 109. The remote location 123 sends a message to the CCL 100 by commanding the AMPS radio 113 to generate a regeneration notification that is received by the MSC 109. The MSC 109 then forwards the regeneration notification to the SMA 104, via the data circuit 108, the SS7/IS41 network 106 and the data circuit 105. Once the SMA 104 receives the notification, the SMA 104 searches the SMA database 128, using the MIN and the MSCID provided by the MSC 109. From the database 128, the SMA 104 determines the following: 1) the CCL identifier for the intended recipient; 2) the class of service used by the CCL; and 3) and the wireless access method used by MSC 109. The SMA 104 compares the class of service used by the CCL 100 and the wireless access method used by MSC 109 to determine whether the data needs to be converted. If so, the SMA 104 converts the data. The data is delivered to the CCL 100 using the data circuit 103, public voice/data transport 102 and the data circuit 101.

In a further example, the CCL 100 sends data to the remote location 125. The remote location 125 is associated with a TDMA radio 121 and the TDMA radio is served by MSC 117. The CCL 100 sends the MIN of the TDMA radio 121 along with the data to the SMA 104. The SMA 104 determines from the SMA database 128 that the MIN corresponds to the TDMA radio 121; short message system (SMS) is the class of service; the MSC 117 serves

the radio 121, and the method of transport between the SMA and the MSC 117. In this example, the method of transport is via data circuit 105 and SS7/IS41 network 106. Once this information is retrieved, the SMA 104 sends an IS41 SMS message to the MSC 117 through data circuit 105, the SS7/IS41 network 106, and data circuit 116. Then, MSC 117 sends a SMS message to radio 121, which in turn delivers the data to remote location 125 to complete the transaction.

In a further example, the remote location 125 sends data to the CCL 100. The remote location 125 is associated with the TDMA radio 121 and the TDMA radio is served by MSC 117. The remote location 125 commands the TDMA radio 121 to originate an SMS message, which is received by the MSC 117 and transported to the SMA 104. The SMS message is transported to the SMA 104 through circuit 116, the SS7/IS41 network 106 and, the data circuit 105. The SMA 104 then searches the SMA database, using the MIN and the MSCID provided by the MSC 117, and determines: the CCL identifier; the class of service used by the CCL identified by the CCL identifier; and the wireless access method used by the MSC 117. The SMA 104 compares the class of service used by the CCL 100 and the wireless access method used by the MSC 117 to determine whether the data needs to be converted. If so, the SMA 104 converts the data. The data is then delivered to the CCL 100 using the data circuit 103, the public voice/data transport 102 and the data circuit 101.

In yet a further example, the CCL 100 wishes to send data to the remote location 126. The remote location 126 is associated with a CDMA radio 122 and the CDMA radio is served by MSC 119. The CCL 100 sends the MIN of the CDMA radio 122

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While a preferred embodiment has been set forth above, those skilled in the art who have reviewed the present disclosure will readily appreciate that other embodiments can be realized within the scope of the present invention. For example, transmission between the CCL 100 and the SMA 104 can take place through any suitable network, such as a TCP/IP Network. Also, any SMS protocol can be used. Therefore, the present invention should be construed as limited only by the present claims.

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